

# THE GENUS *PIPER* LINN. IN KARNATAKA, INDIA<sup>1</sup>

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(With eight text-figures)

The family Piperaceae, until 1940, was limited to two genera viz., *Piper* Linn., and *Peperomia* Ruiz. & Pav. In 1843, F.A.W. Miquel subdivided it into several ranks and described about 600 species under 20 different segregate genera. Since then, the family has undergone considerable changes in the circumscription of various taxonomic ranks. In India, 108 species have been reported from two independent 'centres of distribution'. They are 1) the region of Sub-Himalayan and North-eastern hill ranges and 2) South Deccan. In the present paper an attempt is made, to revise the taxonomy of *Piper* species occurring in the Karnataka region of Deccan, based on the authors' survey of the region under study and collection of over 300 herbarium specimens. In all 8 species have been described. An artificial key for the Karnataka species, field notes, nomenclatural notes, comments on affinity, world distribution, distribution in India and in Karnataka and type locality are provided.

The genus *Piper* Linn., the largest in the family Piperaceae, occurs throughout the tropical and subtropical regions. More than 3000 species are on record (INDEX KEWENSIS 1895-1970, Rahiman 1983). Because of the large number of species, wide distribution, very minute, achlamydous and closely packed flowers, unisexual nature of many of the species and lack of any recent critical phyletic study (Hooker 1886; Gamble 1925; Lawrence 1951), a valid acceptable species concept could not be established till to date. Until 1940, Piperaceae was limited to two genera namely *Piper* Linn. and *Peperomia* Ruiz. & Pav. In 1843, F.A.W. Miquel in his monograph SYSTEMA PIPERACEARUM subdivided the family into several ranks such as tribe, section, cohorts,

genus and species and described about 600 species of *Piper* under 20 different segregate genera. As the report of new species from all over the world accumulated and the number of species went on increasing, the segregate genera started losing their distinctions, mainly because of the lack of sharp taxonomic discontinuities within the family. In 1869, C. de Candolle in DC PRODROMUS merged these segregate genera into 9 major genera. Hooker (1886) further reduced the number of genera to three and described the various *Piper* species under 4 sections. Contemporary taxonomists discontinued even, the practice of subdividing the genus into sections and dealt the species directly under the genus. From taxonomic point of view, Piperaceae has been considered as a most difficult family. According to Howard (1973), the family is one of the worst messes in plant taxonomy. Because of all these problems and also due to the poor quality of the herbarium specimens of pioneering workers, Sir Joseph Hooker (1886) advised the local botanists in

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various 'centres of distribution' of species in Indo-Malayan region to "examine the plants on the spot, with a view to matching the sexes, and flowering with fruiting specimens, and to observing the transition from young to old foliage, and the effects of locality and climate on the character of each species". In India, two major, independent centres of distribution of species are recognized. They are: 1) the region of Sub-Himalayan and North-eastern hill ranges and 2) Southern Deccan. More than 108 species are recorded from India (Rahiman & Nair 1983). In the present investigation, systematics of all the species occurring in the Karnataka region of Deccan were taken up. However, the study does not include *P. betle* Linn. (betel vine) which has not been recorded in the wild state in India and cultivars of *P. nigrum* Linn. (common black pepper vine). The observations are based on a survey of the *Piper* species in Karnataka by the authors (Rahiman *et al.* 1979, 1981) in which more than 300 herbarium specimens were specially collected for the study.

KEY TO THE SPECIES

1. Spike pendulous, berry large or medium-sized, bracts adnate or decurrent at lower half, not pedicelled:
  2. Bracts adnate to the rachis at the medial position, margin narrow but free, berry does not attain red colour:
    3. Female spikes long, developing berry oblong ..... *attenuatum*
    3. Female spikes short, developing berry ovate:
      4. Leaves, peduncle and young branches hirtellous ..... *hookeri*
      4. Leaves, peduncle and branches glabrous, rarely minutely puberulous ..... *argyrophyllum*
  2. Bracts decurrent at lower half, berry large, becomes reddish ..... *nigrum*
  2. Bracts transformed into a fleshy cup:

5. Outer surface of the cup puberous ..... *trichostachyon*
5. Outer surface of the cup glabrous ..... *galeatum*
1. Spike erect, berry small, bracts peltate with a short pedicel:
  6. Fruiting spike sub-globose, leaf base acute ..... *mullesua*
  6. Fruiting spike cylindric, leaf base symmetrically or asymmetrically cordate ..... *longum*

**P. attenuatum** Ham. *ex* Miq., Syst. Pip. 306. 1843 & in Fl. Ind. Bat. 1(2): 451. 1859; J. Hooker, Fl. Brit. India 5: 92. 1886; Gamble, Fl. Madras 1205. 1925. *P. diffusum* Vahl. Enum. 1: 333. 1804. *P. Karok* Blume, Cat. Gew. Buitenz 33. 1823. *P. malamaris* Roxb., Fl. Ind. 1: 160. 1832. *P. Sirium* C. DC., in DC., Prodr. 16(1): 160. 1869. (Fig. 1).

A slender climber, dioecious. Leaves thin, pressed ones membranous-chartaceous, ovate, rarely cordate, 9.5-17.5 cm long and 4.0-8.5 cm broad, glabrous, sometimes minute white dots seen on the dorsal surface, ventral side green, dorsal, dark green, 2-3 pairs of prominent lateral ribs, all arising from the base or very near to it; stipule adnate, deciduous. Flowering spike narrow, filiform, ♂ upto 26.0 cm, ♀ upto 10.0 cm, fruiting spike upto 21.0 cm, peduncle glabrous. Bracts linearly-obovate to elliptic, sessile, adnate in the medial position with narrow but free margin. Stamens 3, rarely 4. Carpel single, astylocarpellous, ovary oblong, stigma mostly 4-lobed, lobes short, ovule solitary, erect. Berry, mature ones spherical, developing ones characteristically oblong, smaller than the commercial black pepper, 0.3-0.4 cm in diameter, bitter in taste.

Climbs over the supporting trees with the help of strong adventitious roots, not more than 5-9 m in height. The fruit is an indehiscent drupe but commonly treated as berry.

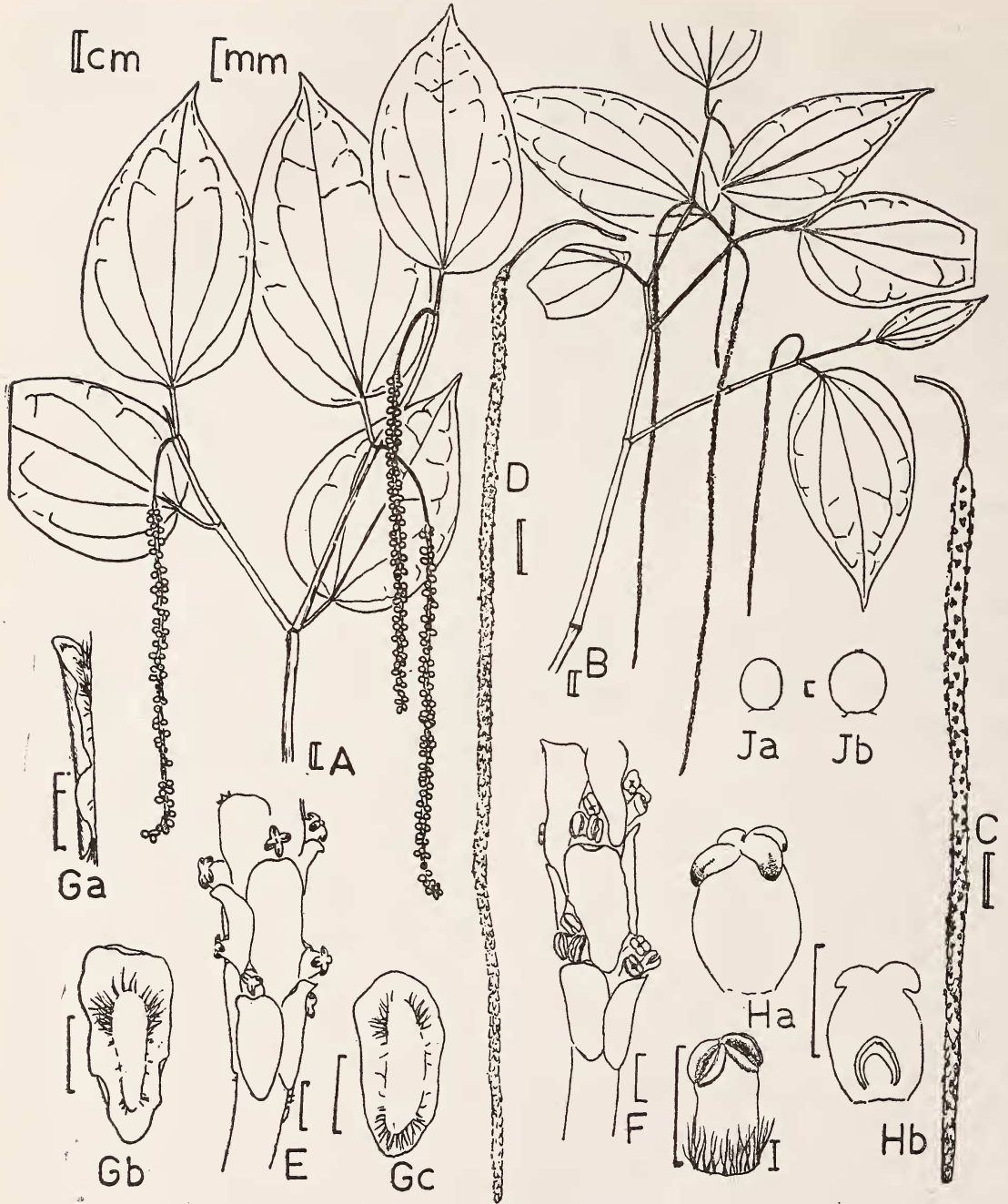


Fig. 1. *P. attenuatum* Ham.

A. Branch with fruiting spikes; B. Branch with male spikes; C. Female spike; D. Male spike; E. Portion of female spike; F. Portion of male spike; Ga. Female bract—side view; Gb. Female bract—bottom view; Gc. Male bract—bottom view; Ha. Ovary; Hb. Ovary—L.S.; I. Stamen; Ja. Young berry; Jb. Mature berry.

Young berry green in colour, mature ones black. Unlike *P. nigrum* Linn. the berries do not attain red colour during the development. Number of mature berries drop before fully mature. Runners are in plenty, cuttings of the runners start flowering in the very next season of planting. Flowers in May-July period. Off season flowerings common.

Saldanha and Nicolson (1976) considered *P. attenuatum* as synonym of *P. trioecum* Roxb. and Gamble (1925) considered the latter under *P. attenuatum*. Miquel (1843) and C. de Candolle (1869) considered them as two distinct species. *P. trioecum* was established by Roxburgh (1820). In his FLORA INDICA he described a male, a female and a bisexual vine. A close perusal of the descriptions of these 3 vines furnished by him clearly showed contrasting diagnostic characters — the bisexual vine showed 2 stamens and the berries which are pungent, ripened perfectly in the spike and the male one showed 3 stamens and the berries which are non-pungent, dropped before full maturity in the spike. (The former set of characters are similar to the characters observed in *P. nigrum* and the latter, are similar to that of *P. attenuatum*). From this it is obvious that these vines do not belong to one and the same species as William Roxburgh believed. The type specimen of *P. trioecum* is not available in any Indian Herbarium and the figure given by Wight (1853) in the ICONES PLANTARUM INDIAE ORIENTALIS, though said to be taken directly from Roxburgh's drawings, is not of much help to determine the identity. Hence the epithet *P. trioecum* is ignored in the present study.

**Distribution:** Bangladesh, Bhutan, Sri Lanka and Malaysia. In India, the Himalaya, Sikkim, Assam, Meghalaya and the Western Ghats. In Karnataka, very common in low level forests (lower than 200 m MSL)

of Uttara Kannada and Dakshina Kannada districts.

**Type locality.** The Himalaya.

**Selected specimens examined.** Wallich 6642 D (CNH); Ansari 78563, Subramanian 77003 (BSI); Barber 5051; Henry 17394, 48263, Hooker & Thomson *exciccata* sin. num., acc. no. 70410, Joseph 17190, 44488, Narayana-swami 3537, 5373, Raju & Naganathan 18146, 18156, 18206, Ramamoorthy 16153, Sebastine 15688, 16520, 25055, Subbarao 24528, 30052, 32877, 44384, 42575, Subramanyan 3846, 8066, Vajravelu 32131, Wight *sin. num.*, acc. no. 43777, 43778, 43779, 10881, 15723 (MH); Nicolson & Ramamoorthy 246, Saldanha 10068, 11412, 13899, 14232, 14415 (CTS)<sup>4</sup>; Rahiman 29, 33, 34, 37, 40, 49, 50, 65, 69, 70, 74, 115, 142, 143, 208, 229, 240, 254, 259, 262, 268 (MUK)<sup>5</sup>.

**P. hookeri** Miq., London J. Bot. 4: 437. 1845; J. Hooker, Fl. Brit. India 5: 88. 1886; Gamble, Fl. Madras 1204. 1925. *P. hymenophyllum* Miq., London J. Bot. 4: 437. 1845. *P. lanatum* Wight *ex* Miq., London J. Bot. 5: 533. 1846. non Roxb. 1832. *P. nilighirianum* C. DC., in DC., Prodr. 16(1): 364. 1869. *P. Wightii* Miq., London J. Bot. 5: 552. 1846 (Fig. 2).

Allied to *P. attenuatum* Ham. *ex* Miq. and *P. argyrophyllum* Miq. Resembles *P. attenuatum* in majority of morphological characters. The major differences are the presence of crisp hairs on young branches, entire ventral surface and along the major ribs on dorsal surface of the leaves, petiole and bracts in this species. Leaves thinly coriaceous, upto 17.0 cm long and 7.0 cm broad, very much variable in size, shape and thickness. ♂ spikes upto 14.0 cm, fruiting spikes upto 20.0 cm, stamens 3 in number.

<sup>4</sup> CTS — Centre for Taxonomic Studies, Bangalore, Karnataka.

<sup>5</sup> MUK — Mangalore University, Mangalore (Konaje), Karnataka.

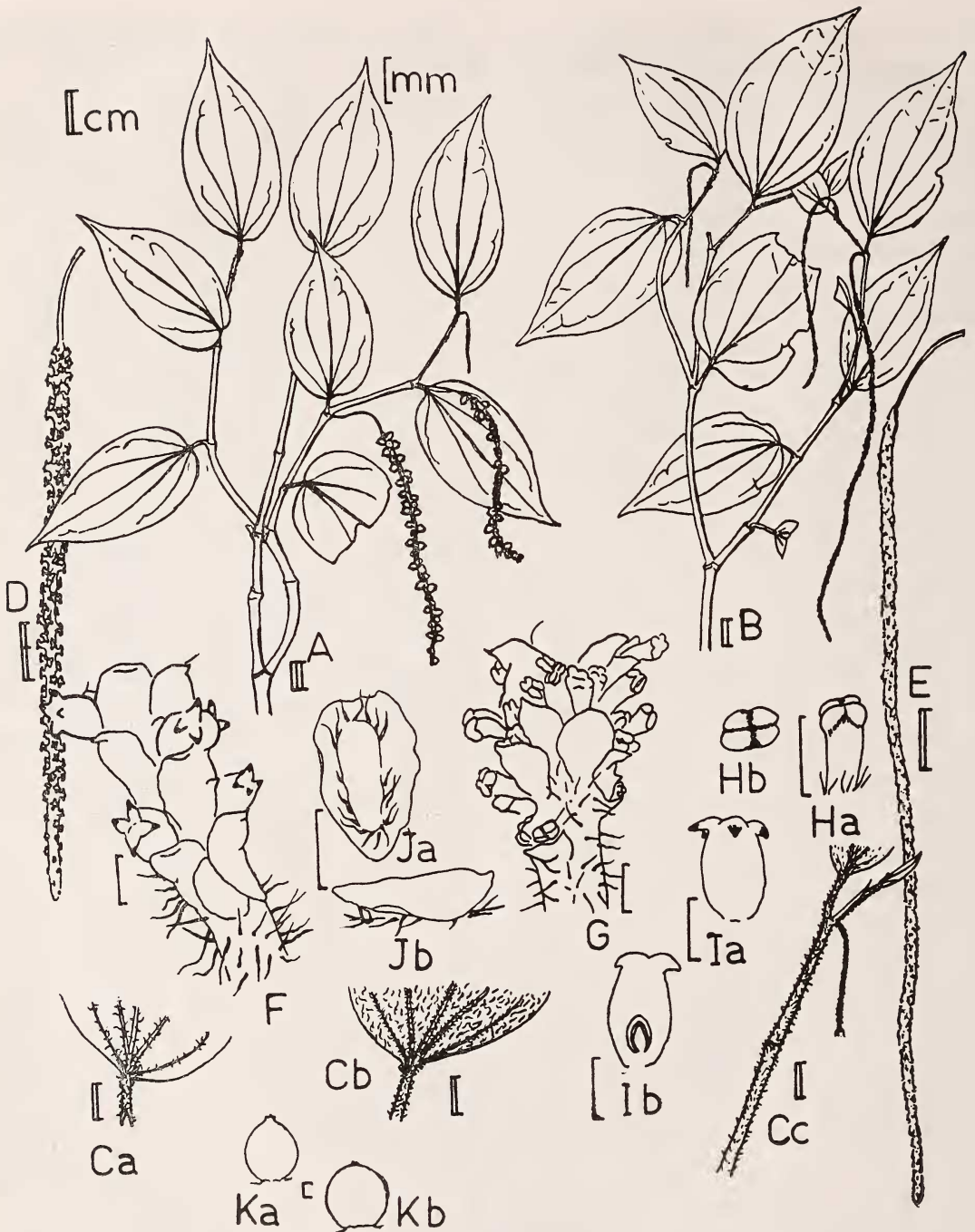


Fig. 2. *P. hookeri* Miq.

A. Branch with fruiting spikes; B. Branch with male spikes; Ca. Portion of leaf—dorsal side showing hairs; Cb. Portion of leaf—ventral side showing hairs; Cc. Tip of the branch showing hairs; D. Female spike; E. Male spike; F. Portion of female spike; G. Portion of male spike; Ha. Stamen; Hb. Anther lobes — top view; Ia. Ovary; Ib. Ovary — L.S.; Ja. Bract — bottom view; Jb. Bract — side view; Ka. Young berry; Kb. Mature berry.

Some problem pertaining to the identity of this taxa was encountered in the literature. Brandis (1906) and Cooke (1903) described a species with hairy vegetative and floral parts from the Western Ghats and considered it as *P. hookeri*. Saldanha and Nicolson (1976), on the other hand, considered a similar taxa from Karnataka as *P. hymenophyllum*. Hooker (1886) and Gamble (1925) described two such taxa from the Western Ghats and identified them as two distinct species, namely *P. hookeri* and *P. hymenophyllum*. Gamble (1925) reported the former from Bababudan hills (Bababudan hills are situated in the Karnataka region of the Western Ghats) and the latter from the Western Ghats of Mysore (Karnataka). We studied a number of specimens with hairy nature from all over Karnataka including Bababudan hills. The morphological characters showed wide variation but did not show any sharp discontinuities to merit differentiation into two species. *P. hookeri* and *P. hymenophyllum* were established by Miquel in 1845 and 1846 respectively. In the original diagnosis, the differences mentioned were the presence of adnate bract in *P. hookeri* and linear-oblong, adnate bract with undulated margin in *P. hymenophyllum* and the coriaceous to membranous leaves in the former and finely membranous and transparent leaves in the latter. In all other characters the two were identical. The leaf characters, as Miquel himself remarked were variable in these two species. In the light of variability noticed in the morphological characters in the genus, the differences mentioned in the original diagnosis are quite inadequate to differentiate these two into two different species. Therefore it would be realistic to consider these two species as conspecific. Since *P. hookeri* was validly published in 1845 and *P. hymenophyllum*, in 1846, the former is to be considered as the valid specific

epithet. Therefore, in the present work, the hairy species is considered as *P. hookeri*.

*Distribution*: Reported only from the Western Ghats and Biligirirangan hills. In Karnataka occurs in Uttara Kannada, Shimoga, Hassan, Kodagu, Chikmagalur and Mysore districts, mostly in the forests situated at more than 200 m above sea level.

*Type locality*. Bombay.

*Selected specimens examined*: Arora 46275, 55232, Chibber *sin num.*, Janardhan 72150, Mahajan 24792, Pan 14462, Rao 79970, Rolla 87487, Raghavan 62477, 67853, 80838, 86982, 94119, Talbot 1602, 2459, Reddi 97261, 97826, *Exiccata sin. num.*, acc. no. 6962 (BSI); Barber 5450, 5489, 7555, 7539, 7559, 7560, 7563, 7595, 7346, Bourne 6112, 6085, Ellis 16957, Jacob 391, 427, 17666, Ramamoorthy 18188, 22882, Sebastine 17275, Viswanathan 691 (MH). Nicolson, Ramamoorthy & Gandhi 2884, Ramamoorthy & Gandhi 2608, Saldanha 9049, 9053, 10704, 13581, 16753 (CTS); Rahiman 12, 890, 893, 905, 910, 911, 957, 958, 984, 998, 1000, Fc 230, 231, 236, 248, 258 (MUK).

***P. argyrophyllum*** Miq., Syst. Pip. 330. 1843; J. Hooker, Fl. Brit. India 5: 93. 1886; Gamble, Fl. Madras 1205. 1925. *P. walkeri* Miq., London J. Bot. 4: 438. 1845. *P. Wightii* Miq., London J. Bot. 5: 552 in part 1846. (Fig. 3).

Allied to *P. attenuatum*. It differs from *P. attenuatum* by the presence of silvery scales or blotches on the ventral surface of the leaves. Leaves chartaceous to thinly coriaceous, upto 21.0 cm long and 7.0 cm broad, sometimes sparsely distributed minute hairs are also seen on the ventral side. Stamens 3 in number. Rarely *P. argyrophyllum* may lack silvery blotches and *P. attenuatum* may show similar blotches in some leaves and as such it is very difficult to separate these two species, especially based on herbarium specimens. It

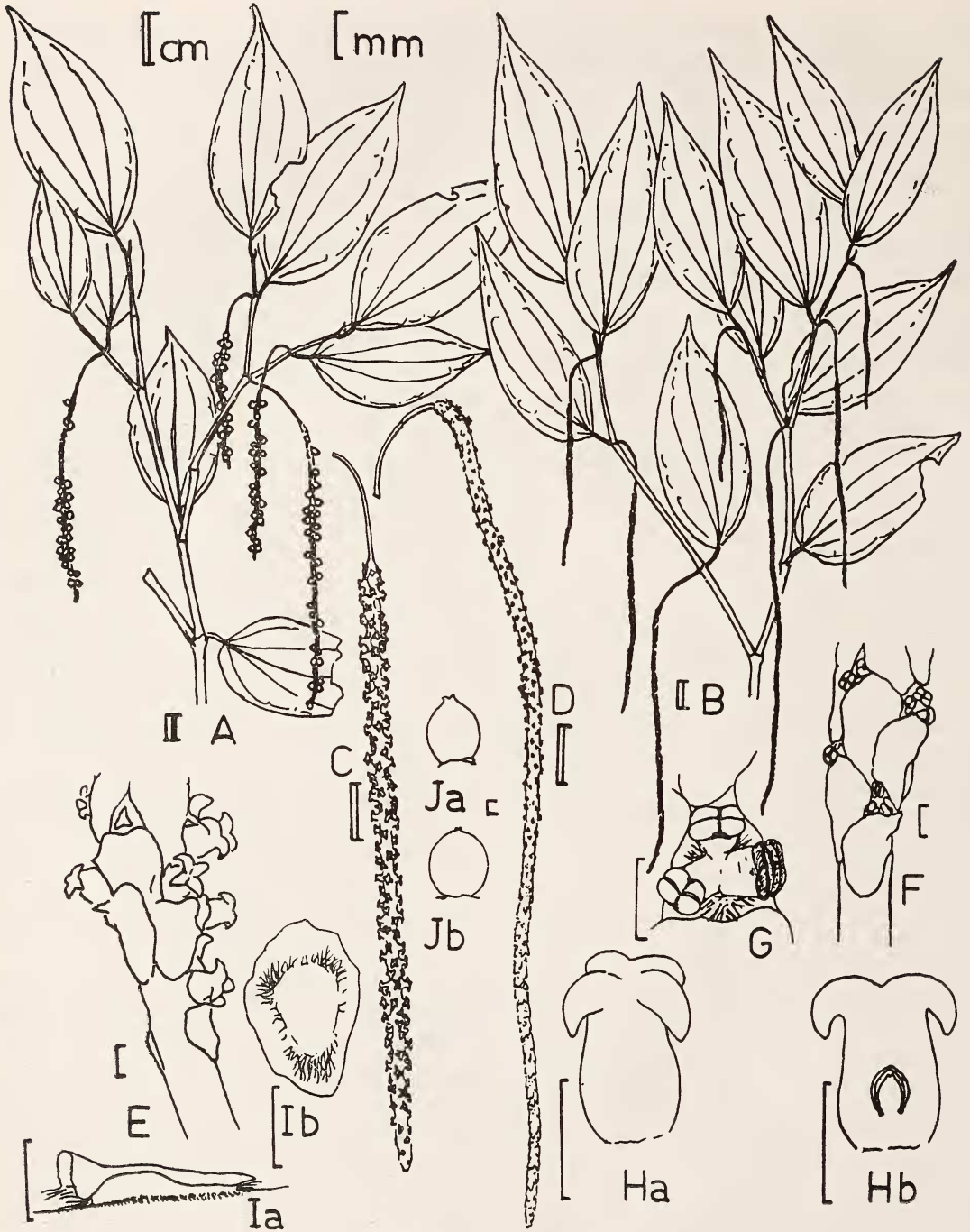


Fig. 3. *P. argyrophyllum* Miq.

A. Branch with fruiting spikes; B. Branch with male spikes; C. Female spike; D. Male spike; E. Portion of female spike; F. Portion of male spike; G. Portion of male spike showing stamens; Ha. Ovary; Hb. Ovary — L.S.; Ia. Bract — side view; Ib. Bract — bottom view; Ja. Young berry; Jb. Mature berry.

is also allied to *P. hookeri* and because of the presence of sparsely distributed hairs, poses difficulty in separating these two species as well.

*Distribution:* In India reported only from the Western and the Eastern Ghats. In Karnataka, occurs in Chikmagalur, Hassan, Shimoga, Kodagu, Uttar Kannada and Mysore districts. Occurs in higher altitude forests. Both *P. argyrophyllum* and *P. hookeri* are seen in the same locality.

*Type locality.* The Western Ghats.

*Selected specimens examined.* Fisher *sin. num.*, Singh 124569 (BSI); Barber 6498, 7202, 7313, 7344, 8710, 8712, 8713, 8715, Ellis 34891, Gamble 18392, Henry 16282, 16286, Joseph 12705, 12793, 13789, Karthikeyan 26834, Narayanaswamy 3875, Shetty 32327, Rao 31999, Vajravelu 33840, 35123, 41724 (MH); Nicolson & Ramamoorthy 2866 (CTS); Rahiman 165, 167, 172, 207, 212, 213, 228, 230, 240, 244, 253, 255, 257, 258, 263 (all the specimens fully glabrous), 209, 231, 232, 240, 242, 243, 264, 272 (all are puberulous in young vegetative parts) (MUK).

**P. nigrum** Linn., Sp. Pl. 28. 1753; Roxb., Fl. Ind. 1: 150. 1832; Gamble, Fl. Madras 1204. 1925; *Piper rotundum nigrum* Casparus, Fl. Mal. 54. 1696. *P. aromaticum* Lam., Illust. 1: 79. 1791. *P. baccatum* C. DC., in DC., Prod. 16(1): 242. 1869. *P. colonum* Presl, Bot. Bemerk. 112. 1844. *P. fallax* Vahl, Enum. 1: 335. 1804. *P. glypticum* Hoffmag. ex Kunth, in Linnaea 13: 573. 1839. *P. malabarensis* C. DC., in DC., Prodr. 16(1): 242. 1869. *P. spurium* Link, Enum. Hort. Berol. 1: 37. 1821. *Muldera multinervis* Miq., London J. Bot. 5: 557. 1846. *M. Wightiana* Miq., l.c. 558. 1846. (Fig. 4).

A vigorous vine, stem thick, rough in texture. Leaves thick, pressed ones coriaceous, broadly ovate to elliptic, 9.0-21.0 cm long and 2.5-13.0 cm broad, in males usually

smaller and narrower, 2-3 pairs of prominent lateral ribs, the anteriormost pair emerges alternately about 2.0-3.5 cm above the leaf base, entirely glabrous, dorsal side green, ventral light coloured, stipules deciduous, adnate to the petiole. Spike narrow, filiform, pendulous, young ones green, mature ones yellowish, ♂ upto 16.0 cm and ♀ 12.5 cm, female spikes usually much smaller, peduncle glabrous. Bracts in the ♂ linearly oblong, decurrent, sessile, upper half with free margin, in ♀ same as in the male but the upper portion forms a thin hemispherical cup-like depression probably due to the presence of the spherical ovary, outer surface glabrous. Stamens consistently 2. Carpel single, ovary spherical, style represented by a mere constriction, stigma 3-5 lobed, lobes elongate, papillate. Berry spherical 0.5-0.6 cm in diameter, pungent.

Very common in the forest slopes of the Western Ghats, found climbing over the supporting trees both by twining and striking roots at the nodes, ascends to a height of 10 m or more. Flowers during May-June period, off season flowering rare. Fruit in ripening undergoes a colour change from green to red to black. More than 75 cultivars are known to be cultivated for their fruits, which are marketed as the famous 'black pepper'. The cultivars of black pepper are quite similar to the wild ones. The only major difference is the monoecious nature of cultivars and dioecious nature of the wild vines. However, hermaphrodite forms of wild vines and female forms of cultivars are also known.

*Distribution:* Indonesia, Malaysia, and Brazil. In India, occurs wild in the forests of the Western Ghats and the Eastern Ghats and cultivated in Kerala, Karnataka, Tamilnadu and Maharashtra. In Karnataka, both cultivated and wild forms occur in Dakshina Kannada, Uttara Kannada, Shimoga, Kodagu, Chikmagalur and Hassan districts.



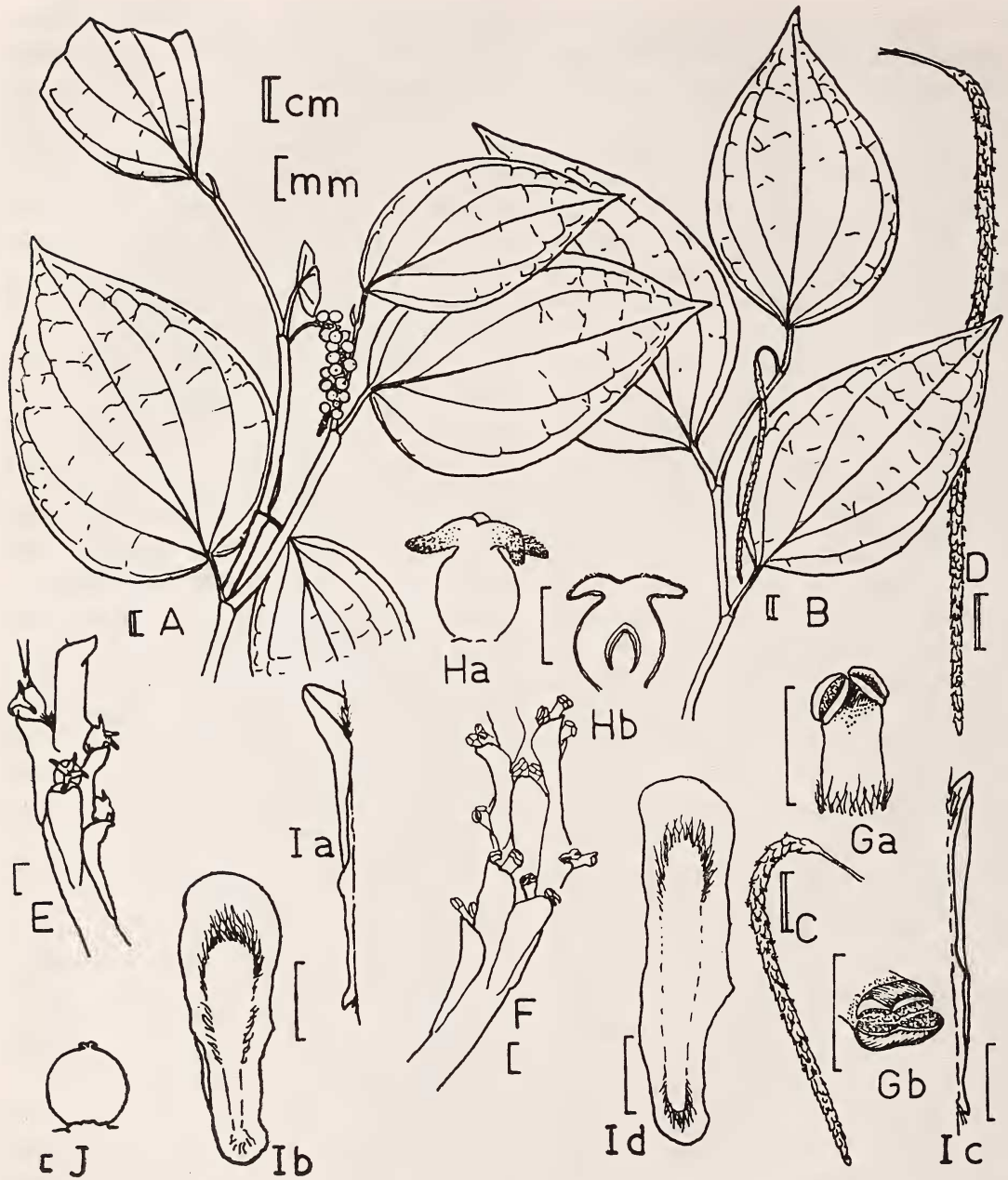


Fig. 4. *P. nigrum* Linn.

A. Branch with fruiting spike; B. Branch with male spike; C. Female spike; D. Male spike; E. Portion of female spike; F. Portion of male spike; Ga. Stamen; Gb. Anther lobes after anthesis; Ha. Ovary; Hb. Ovary — L.S.; Ia. Female bract — side view; Ib. Female bract — bottom view; Ic. Male bract — side view; Id. Male bract — bottom view; J. Mature berry.

*Type locality.* India.

*Selected specimens examined.* Kanodia 9626, Patil 2921, Puri 1114, Rolla 84917, Subramanian 70796, 71600, Wadwa 4313, 109793 (BSI); Barber 5466, 5945, 7410, 7414, 8708, 8709, Bourne 369, Naithani 24170 (MH); Saldanha 11474, 12599, 13274, 14634, 15071, Ramamoorthy & Gandhi 2655 (CTS); Rahiman 3, 4, 5, 6, 19, 22, 36, 38, 42, 43, 73, 75, 76, 85, 86, 95, 111, 112, 114, 116, 117, 122, 130, 132, 148, 200, 210, 211, 239 (MUK).

**P. trichostachyon** (Miq.) C.DC., in DC., Prod. 16(1): 242. 1869. J. Hooker, Fl. Brit. India 5: 80. 1886; Gamble, Fl. Madras 1206. 1925. *Muldera trichostachya* Miq., London. J. Bot. 5: 556. 1846. (Fig. 5).

A stout-stemmed climber. Leaves alternate, coriaceous, entirely glabrous, usually oblong but variable from ovate to lanceolate, upto 20.0 cm long and 10.0 cm broad, in males leaves smaller and narrower, 2-3 pairs of prominent lateral ribs, the anteriormost pair emerges from the midrib simultaneously about 2-3 cm above leaf base, nerves strong beneath, dorsal side green, ventral, light coloured, glaucous in appearance. Spike narrow, filiform, ♂ upto 9.5 cm, ♀ upto 7.0 cm, fruiting spike upto 10.0 cm, peduncle glabrous except for a strip of hairy tissue on the upper portion which might represent the decurrent part of the lowermost bract. Bract decurrent at the base, upper portion transformed into a fleshy obconical or hemispherical cup with a narrow slit like mouth, entire bract puberulous or hirtellous. Stamens consistently 2, short. Carpel single, ovary obovate, style absent, stigma 3-4 lobed, lobes short. Berry spherical or oblong, larger than commercial black pepper, 0.6-0.8 cm in diameter.

Climbs to a height of 10 m or more, stem may grow to a thickness of more than 6.0 cm, covered with thick cork which in old vines, is longitudinally furrowed. Occurs only in

higher altitude forests (more than 700 m above sea level). Compared to all the other species, this one and *P. galeatum* (Miq.) C.DC., are hardy species and can withstand slightly dry climate. These two species are occasionally encountered along with cultivated Pepper in some plantations. Flowers in May-June period, off season flowerings observed. Fruits in ripening undergo a colour change from green to yellow to orange to red, slightly less pungent than commercial black pepper and are sometimes used as adulterant while marketing the latter.

*Distribution:* India and Malaya (Malaysia). In India reported only from the Western Ghats. In Karnataka, Shimoga, Chikmagalur, Coorg, southern part of Uttara Kannada and western part of Hassan districts.

*Type locality.* Malabar (Kerala).

*Selected specimens examined.* Cooke 46350 A, Arora 85576, Rao 79977 (BSI); Jacob 537, Narayanaswami 3538, 5407, Subramanyam 27703, Vivekanathan 45642, Wight *exciccata* *sin. num.*, acc. no 43008, 43009 (MH); Saldanha 12247, 15775, 15798, Nicolson, Saldanha & Ramamoorthy 37 (CTS); Rahiman 62, 105, 107, 121, 138, 144, 147, 155, 162, 163, 178, 187, 191, 196, 201, 202, 203, 210, 213, 233, 234, 235, 237, 246, 266 (MUK).

**P. galeatum** (Miq.) C.DC., in DC., Prodr. 16(1): 242. 1869; J. Hooker, Fl. Brit. India 5: 80. 1886; Gamble, Fl. Madras 1206. 1925. *P. Talbotii* C.DC., in Fedde, Repert. 10: 523. 1912 *nomen. Muldera galeata* Miq., London J. Bot. 5: 557. 1846. (Fig. 6).

Similar to *P. trichostachyon* in all the characters except for the absence of hairs on the outer surface of the bracts. Young spikes are pink in colour in some vines and green in others.

Several botanists including Miquel (1846), C. de Candolle (1869), Hooker (1886) and

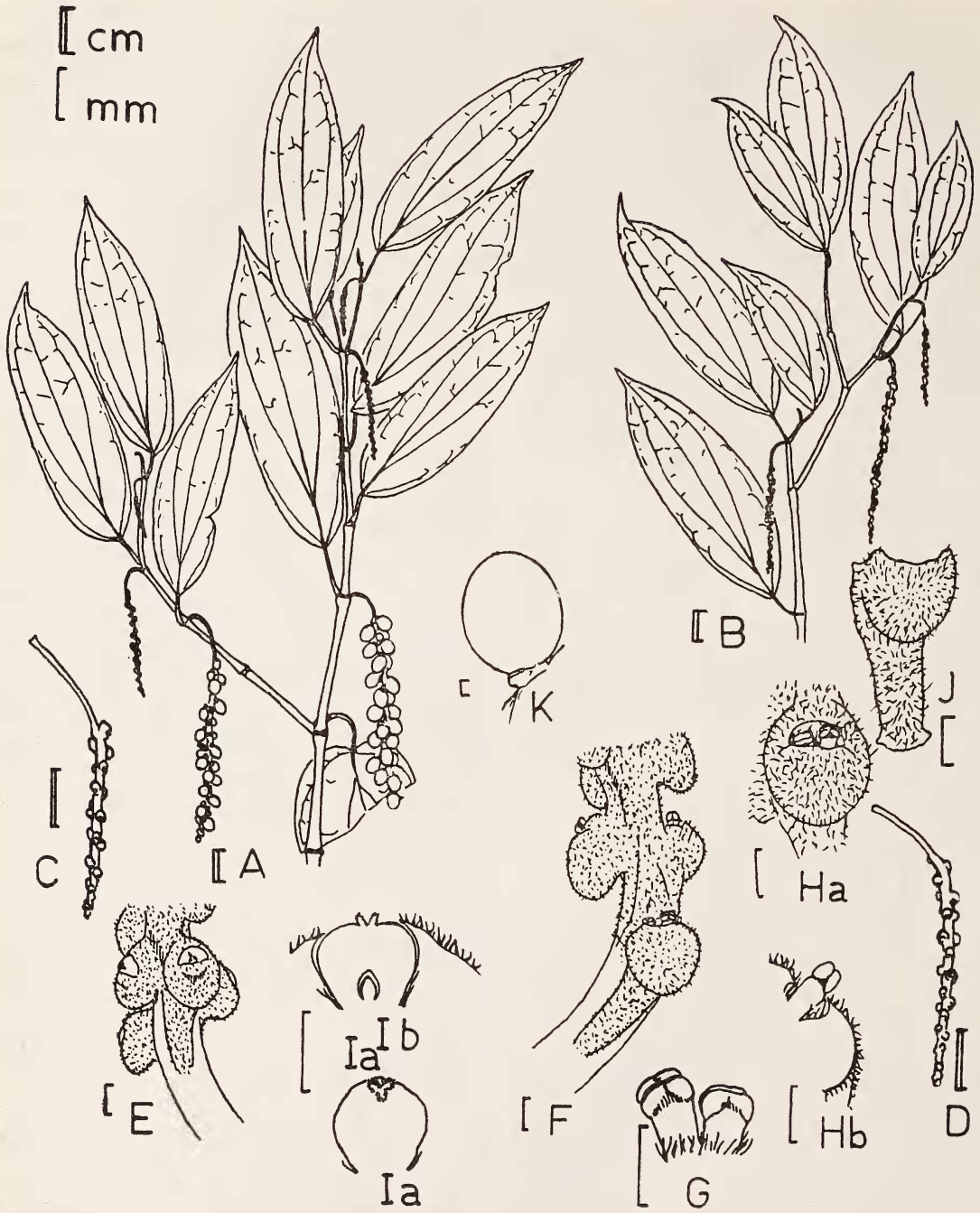


Fig. 5. *P. trichostachyon* C. DC.

A. Branch with fruiting spike; B. Branch with male spike; C. Female spike; D. Male spike; E. Portion of female spike; F. Portion of male spike; G. Stamens; Ha. Flower showing stamens; Hb. Flower with stamen — L.S.; Ia. Ovary; Ib. Ovary — L.S.; J. Bract; K. Mature berry.

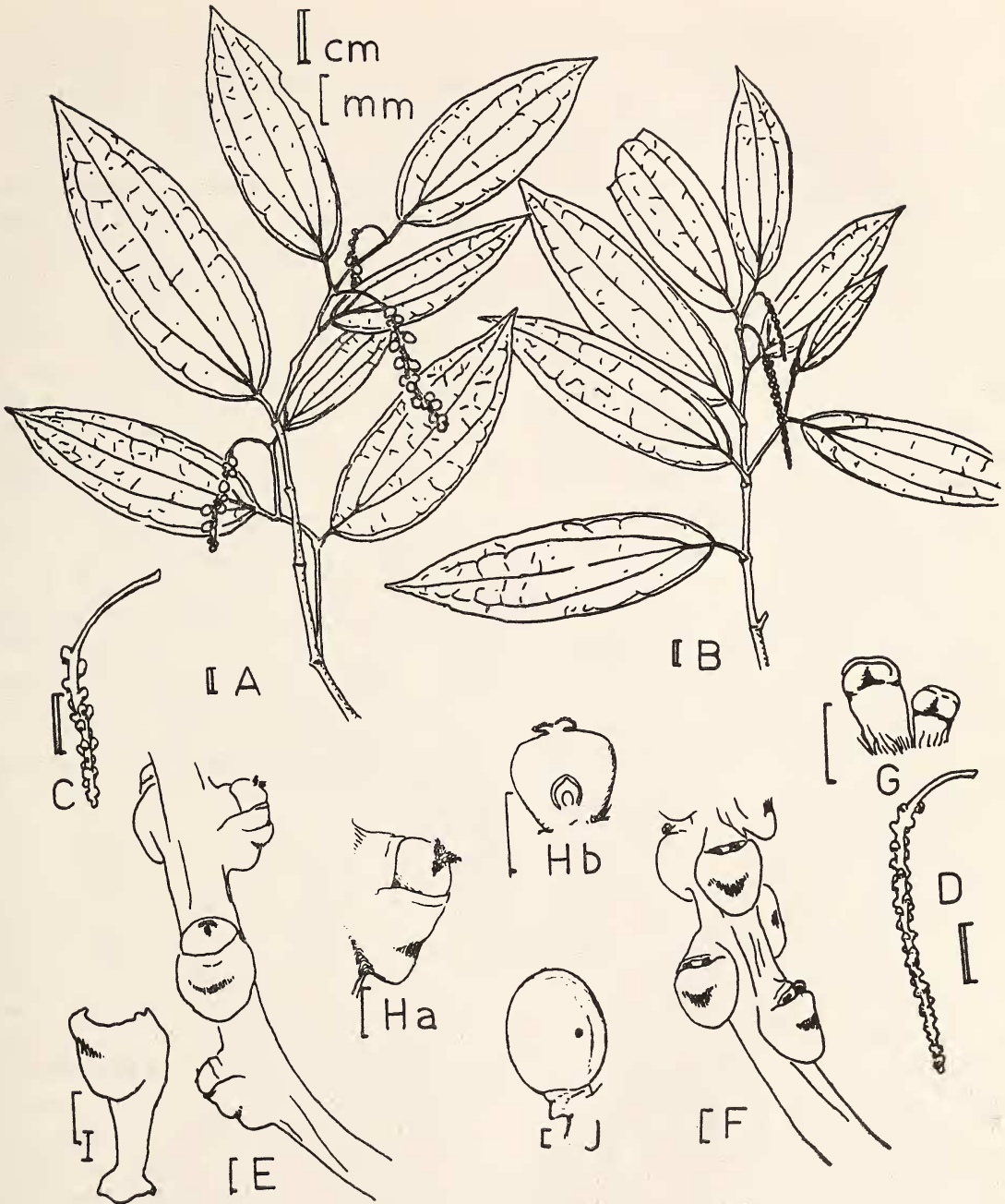


Fig. 6. *P. galeatum* C. DC.

A. Branch with fruiting spikes; B. Branch with male spikes; C. Female spike; D. Male spike; E. Portion of female spike; F. Portion of male spike; G. Stamens; Ha. Female flower; Hb. Ovary — L.S.; I. Bract; J. Mature berry.

Gamble (1925) distinguished *P. galeatum* from *P. trichostachyon* by distantly arranged flowers, presence of sessile bracts and absence of hairs on the outer surface of the bracts in contrast to the closely placed flowers, stipitate bracts and presence of hairs on bracts. Of these, the first two characters are of relative nature. While the typical *P. galeatum* from Cardamom hills shows stipitate and distantly placed flowers, the same species occurring in Anamalai hills shows almost sessile and comparatively closely placed flowers<sup>6</sup>. *P. galeatum* from Karnataka region also shows almost sessile and very closely placed flowers. The third character, namely the presence and absence of hairs, on the other hand, is an absolute character and hence could alone be taken as the diagnostic character to distinguish these two species.

*Distribution:* India and Java. In India, the Western Ghats from Bombay to Yellapur of Karnataka and from Anamalai hills to Travancore hills. In Karnataka, northern part of Uttara Kannada district.

*Type locality.* Peninsular India (Courtallum of Tamilnadu?)

*Selected specimens examined.* Talbot 1219 (CNH); Ahuja 31626, 47696, Cooke *exciccata sin. num.*, acc. no. 12333, 16689, Hemadri 104440, Janardhan 70108, 76614, 81777, Mahajan 17176, Puri 12605, Reddi 85946, 95813, 99326, Ryan 1757, Rolla 83427, Talbot 1593, 2888, Vasavada 9320 (BSI); Barber 5426, 5441, 5467, 5483, 5484, 5485, 5486, 7192, Ramamoorthy 16145, Wight *exciccata sin. num.*, acc. no 42973 (MH); Rahiman 53, 54, 55, 56, 57, 58, 59, 270, 273, 297 (MUK).

*P. mullesua* Ham., ex D. Don, Prod. Fl. Nep. 20. 1825; C. DC., in DC., Prod. 14(1): 338. 1869. *P. brachystachyum* Wall., in Wall. Cat. 6656 in part. 1832. *P. guigual* Ham. ex D.

<sup>6</sup> C. de Candolle (1912) unpublished document available at Botanical Survey of India, Southern Circle, Coimbatore.

Don, Prod. Fl. Nep. 20. 1825. *P. vasculosum* Wall., Cat. 6660. 1832. *Chavica Guigual* Miq., Syst. Pip. 280. 1843. *C. Mullesua* Miq., l.c. 280. 1843. *C. spherostachya* Miq., l.c. 278. 1843. (Fig. 7).

Slender-branched extensive climber, stem rarely attains more than 1.5 cm thickness, branches entirely glabrous, runners many, characteristically puberulous. Leaves alternate, coriaceous, elliptic, upto 14.5 cm in length and upto 5.5 cm in breadth, usually much smaller in size, tip caudate-acuminate, bent, 2 pairs of prominent lateral ribs of which the anteriormost one emerges about one-thirds above the leaf base, the others emerge from the base, nerves strong beneath, dorsal side green, ventral dark green. Spike erect, cylindrical in male, upto 4.5 cm in length, female very small, oblong, white, about 0.4 cm in length and 0.3 cm in breadth, fruiting spike upto 1.2 cm in length and 0.7 cm in breadth. Bracts orbicular, peltate, pedicelled. Stamens 2, filament short, thick, anther lobes single reniform, attached transversely at the tip of the filament, pollen sacs 2, dehisce by conspicuous longitudinal cleft at the crest and the wall of the sacs recurve and form an umbrella like structure. Carpel single, ovary ellipsoid, style represented by a constriction, stigma mostly 3-lobed, lobes minute. Berry very small, spherical-obovate, very pungent, gives a burning sensation when chewed. Flowers during April-May period, off season flowering common. This species occurs only in very high altitude forests (more than 700 m above MSL).

This species has been commonly treated as *P. brachystachyum* Wall. by many of botanists including Hooker (1886) and Gamble (1925). The specific epithet '*brachystachyum*' was given by Wallich in his CATALOGUE (1832). Later Hooker (1886) published *P. brachystachyum* with requisite diagnosis. However, long before these, i.e. in 1825 itself, Hamil-

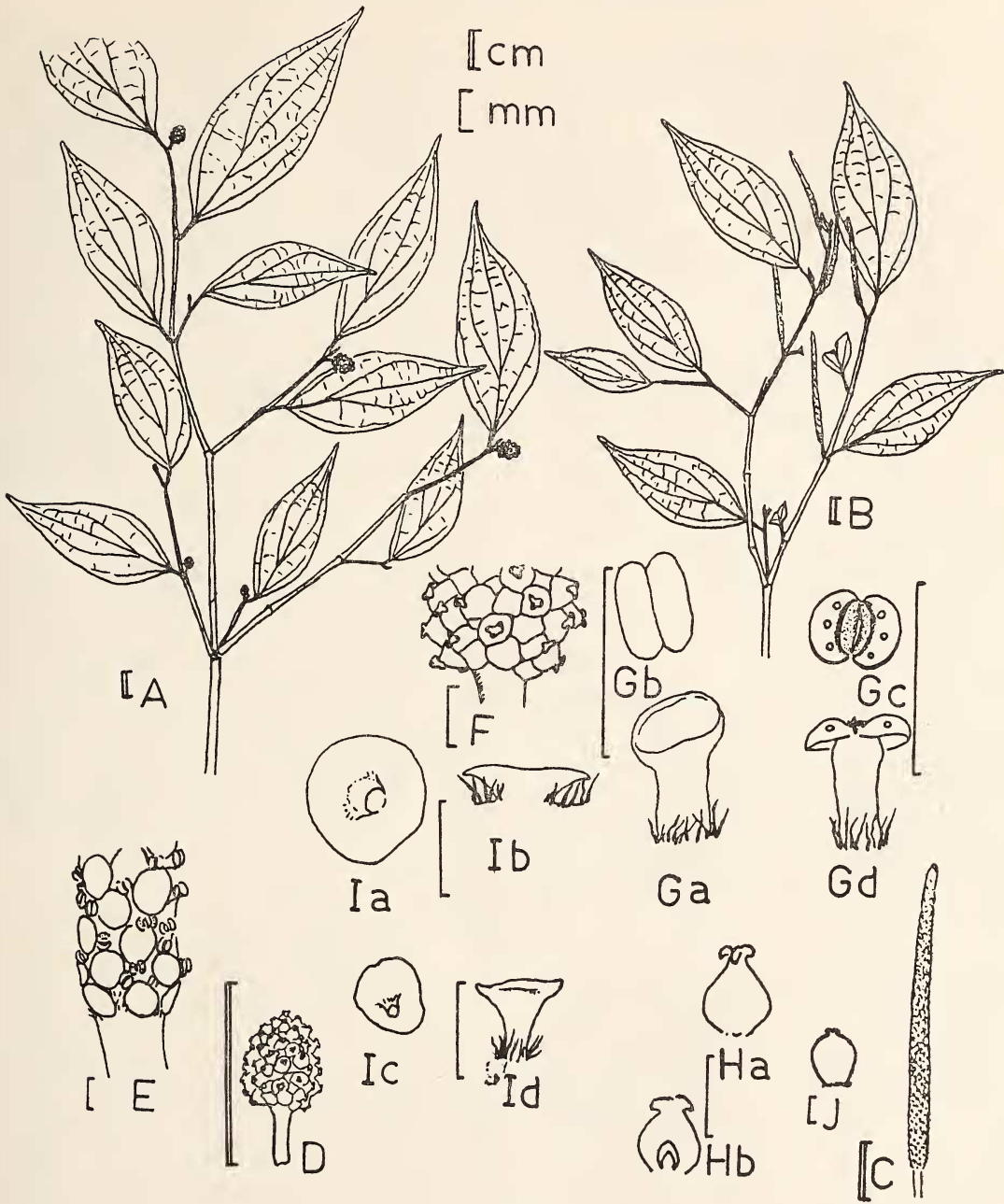


Fig. 7. *P. mullesua* Ham.

A. Branch with fruiting spikes; B. Branch with male spikes; C. Male spike; D. Female spike; E. Portion of male spike; F. Portion of female spike; Ga. Stamen; Gb. Anther lobes — top view; Gc. Anther lobes after anthesis — top view; Gd. Anther lobes after anthesis — side view; Ha. Ovary; Hb. Ovary — L.S.; Ia. Male bract — bottom view; Ib. Male bract — side view; Ic. Female bract — bottom view; Id. Female bract — side view; J. Berry.

ton validly published this species as *P. mullesua* in Don's PRODRUMUS FLORAE NEPALENSIS. Raizada (1966) corrected this by considering *P. mullesua* as the valid name.

*Distribution:* India, Nepal, Bhutan and Eastern Islands. In India, the Himalayas from Simla to Bhutan, Khashi Hills and the Western Ghats. In Karnataka, Chikmagalur, Kodagu and Shimoga districts.

*Type locality.* Nepal.

*Selected specimens examined.* Wallich 6656 (CNH); Gamble 20631, Subramanian 71165, Talbot 3193 (BSI); Balakrishnan 129, Barber 1213, 5436, 5437, 5438, 5447, 5447 a, 5447 b, 5448, 5472, 6546, 6547, 7206, 7207, 7208, 7220, 7314, 7578, Beddome *exciccata* *sin. num.*, acc. no. 43091, Bharghavan 47443, Bourne 2374, Deb 31543, Ellis 34727, Gamble 20630, Henry 16421, Hooker *exciccata* *sin. num.*, acc. no. 70403, 70405, Jacob 16069, 17562, Lawson *exciccata* *sin. num.*, acc. no. 43078, 43088, Narayanswami 3801, 4440, Ramakrishnan 39108, Ramamurthy 18129, Rao 40472, 40489, Sebastine 2561, 3212, 4466, 18444, 24994, Sharma 35873, Vajravelu 29196, 35110, 36833, 38213, 38239, 43171, Viswanadhan 807, 975, Vivekanathan 40614, 40645, Wight *exciccata* *sin. num.*, acc. no. 43081, 43082 (MH); Rahiman 11, 15, 16, 96, 97, 101, 103, 140, 172, 174, 175, 208, 224 (MUK).

***P. longum*** Linn. Sp. Pl. 29. 1753; Roxb., Fl. Ind. 1: 154. 1832; Gamble, Fl. Madras 1203. 1925. *P. sarmentosum* Wall. Cat. 6641. 1832. *P. latifolium* Hunter, in As. Res. 9: 390. 1809. *P. tubinatum* Noronha, in Verh. Batav. Gen. 5: 25, 1790. *Chavica Roxburghii* Miq., Syst. Pip. 230. 1843. *C. sarmentosa* Miq., London J. Bot. 4: 433. 1845; 5: 531 non Syst. Pip. 1846. (Fig. 8).

A slender undershrub, vegetative branches prostrate, rarely climbing to a short height, flowering ones erect or subscentent, young branches puberulous, hair minute but densely

distributed. Leaves on the vegetative branches upto 13.0 cm long and 7.0 cm broad, cordate, equilateral with large auricles, leaves on the fruiting branches cordate to oblong-lanceolate, with inequilateral lamina, base deeply cordate with unequal but deep auricle, 3-4 pairs of prominent lateral ribs, all arise from leaf base, ventral side pale green, downy or puberulous, dorsal, light green, glabrous, petiole downy. Spike cylindrical, erect, ♂ upto 10.0 cm long and 0.4 cm broad, ♀ upto 3.5 cm long and 1.0 cm broad, peduncle downy. Bracts peltate, pedicelled, orbicular, glabrous. Stamens 3-4. Carpel single, ovary obovate, style represented by a mere constriction, stigma 3-4 lobed, lobes short. Berry small, obovate, very pungent, about 0.2 cm in diameter.

*Distribution:* India, Sri Lanka and Malayan Islands. In India, east Nepal to Assam, West Bengal, and west coast of India. In Karnataka, collected only from Dakshina Kannada and Shimoga districts. Being an undershrub which dries and dies in the summer, it is difficult to locate. Among all the species in Karnataka, this is the only species which is found outside the perview of the forests and woodlands.

*Type locality.* India?

*Selected specimens examined.* Ryan *sin. num.*, Subramanian 70562, 77096, 77144, Talbot *exciccata* *sin. num.*, acc. no. 7905, 7906 (BSI). Barber 6078, 6656, 7161, 8728, Beddome *exciccata* *sin. num.*, acc. no. 43091, Bourdillon 449, Deb 30431, 30770, Ellis and Ramamurthy 18796, Henry 85, 16421, Joseph 17825, Narayanswami 3489, Ramamurthy 18129, 47644, Sebastine 717, 20810, 25369, 4466, 18444, Sharma 42451, Shetty 27381, Subramanian 3489, Vajravelu 26277, 33372, 48844, 47443, Wight 886 (MH); Rahiman 1, 77, 78, 215, 222, 267 (MUK).

Several taxonomists described intraspecific categories such as varieties and forms in a

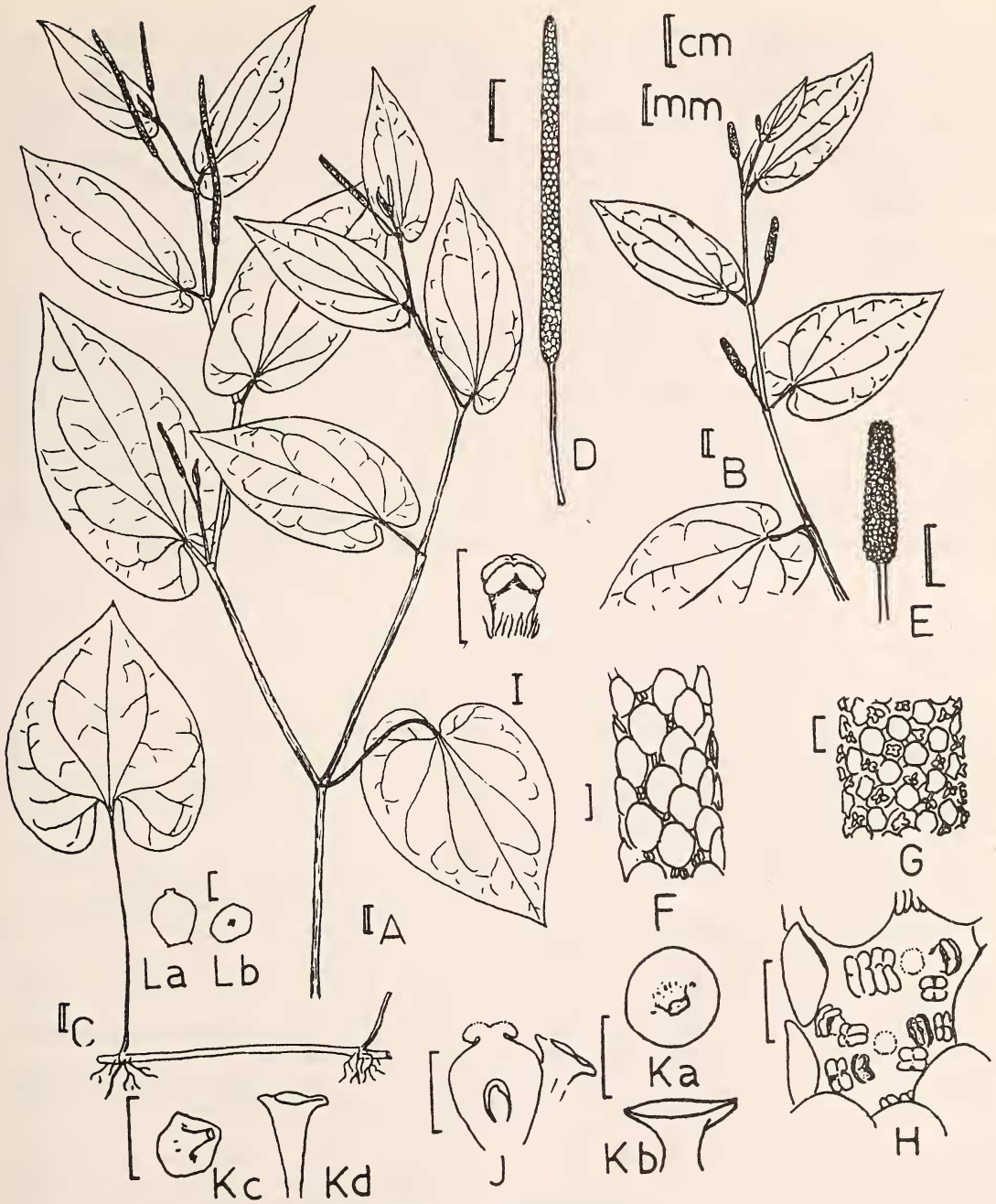


Fig. 8. *P. longum* Linn.

A. Branch with male spikes; B. Branch with female spikes; C. Runner with a leaf; D. Male spike; E. Female spike; F. Portion of male spike; G. Portion of female spike; H. Portion of male spike showing stamens (two of the bract removed); I. Stamen; J. Ovary — L.S.; Ka. Male bract — bottom view; Kb. Male bract — side view; Kc. Female bract — bottom view; Kd. Female bract — side view; La. Berry — side view; Lb. Berry — top view.



number of species of *Piper*. Among the Karnataka species, only a few such as *P. argyrophyllum*, *P. hookeri*, *P. nigrum* and *P. mullesua* were found to include subspecific categories. Hooker (1886) described six varieties under *P. argyrophyllum* but gave them just numbers (1 to 6). Brandis (1906) included a variety  $\alpha$  under *P. brachystachyum* (*P. mullesua*) and a variety  $\beta$  under *P. hookeri*. C. de Candolle (1912) established a variety *mysorensis* under *P. nigrum*. All these varieties are mainly based on some minor variations in the length and breadth of leaves or size variations of spikes and flower parts. Because of the presence of extreme variability in the morphological characters in the genus and due to the absence of sharp taxonomic discontinuities in the characters within the species, it

is not advisable to consider subspecific categories, unless the taxon under study is sufficiently different from the species which it has to be separated from. In the present study, none of the species was found to have sufficient variations to merit subdivision into a distinct variety.

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\* Original not seen.